NOTES ON THE FLIGHT OF GULLS.

BY WILLIAM BREWSTER.

EVERY ornithologist knows, of course, that Gulls are past masters of the art of making headway against strong winds. These they commonly meet and overcome either by flying straight and rather low over the water, with frequent if not incessant wing beats, or by alternately soaring upward and swooping downward on set wings, apparently utilizing as much as possible the momentum acquired by such evolutions or by intermittent flapping, and seeming to follow, with admirable skill and judgment, the lines of least resistance. Under certain conditions, however, they progress by means other than those just mentioned and with surprising ease and celerity, as I have twice witnessed to exceptionally good advantage.

On the first occasion — October 6, 1909 — I was crossing from Liverpool to Boston in the Cunard steamship 'Ivernia' when, after passing the southeastern extremity of Ireland and laying our course to the westward, we were followed, as is usual in those waters, by a perfect swarm of Gulls — chiefly little Black-headed and Herring Gulls with a few Lesser Black-backed and Mew Gulls. Gliding, for the most part, on set and motionless wings close above and around us they kept up with us without apparent effort for a distance of more than one hundred miles although our ship was heading within two points of a heavy wind and ploughing through a tumultuous sea at a speed of sixteen miles an hour. There were nearly always a dozen or more of them floating not more than twelve or fifteen feet over our heads as we stood on the upper deck and keeping so nearly the same positions in relation to our own that whenever we regarded them intently, without taking note of other surroundings, it was difficult to realize that either they or we were not quite motionless. They looked, indeed, like so many admirably stuffed and mounted Gulls suspended by invisible wires. At such short distances and in bright sunlight I watched them for minutes at a time without detecting any movement of their wings, other than that due to occasional flexing or similarly slight readjust-

ment, while their vertical deflections from a horizontal plane of flight were never greater than ten or fifteen inches. Yet all the while the beautiful birds were keeping exact pace with us and moving at a known speed of sixteen miles an hour against a wind having an estimated velocity of considerably more than that. Nor was this the best that they could do for every now and then one which had fallen behind the rest would overtake its companions without flapping or other visible effort although going — perhaps for hundreds of yards — at almost double their rate of speed. How could such a thing be? It seemed unbelievable yet the fact was before our eyes and not to be discredited, however difficult to understand or explain. Those of us who first witnessed and afterwards discussed it agreed in thinking that the gliding birds could not acquire any considerable amount of their momentum by their slight and infrequent swoops or occasional wing strokes. Indeed they seemed, oddly enough, to lose rather than to gain headway whenever they flapped vigorously. It was suggested that their chief if not only means of propulsion must be that of the force of the wind, acting on their set wings somewhat as it does on the sails of a vessel, but objected that no sailing vessel can head within three points of the wind and move forward through the water or fail, when going to windward, to make more or less leeway; whereas the Gulls headed within two points and had no perceptible drift to leeward.

On August 2, 1911, I was again returning from England to America — this time in company with my friends Dr. and Mrs. Glover M. Allen — when our steamship, the White Star liner 'Arabic' was attended, during most of the afternoon and for a distance of above a hundred miles off the south coast of Ireland, by from fifty to two hundred Gulls, the number varying from hour to hour within these limits. Nearly all were adult Herring Gulls still in full nuptial plumage. A few followed the creamy wake of the ship or poised directly over her just to the rear of her smoke stack but the majority kept abreast of her to the windward side, the somewhat sheltered lee side being persistently avoided. On a level with her upper deck or a little above it, they were generally and rather evenly distributed — although more thickly in places than in others — all the way from her stern to amidships, some

keeping within a yard or two of the rail, others thrice that distance off, still others fifty or more yards out over the water. Their respective positions in relation to each other and to the ship were so accurately and systematically maintained that whenever I got one of them in line with any fixed object on the deck I could often hold it there, without myself moving again, for several successive minutes. At first, when the wind was coming from about two points off our larboard bow and blowing not more than twenty miles an hour, the Gulls flapped rather frequently although most of them glided on set wings the greater part of the time. As the afternoon wore on the wind shifted and freshened until it came within a point and a half of being dead ahead — in the opinion of our Boatswain — and attained a velocity of thirty-five miles an hour — according to our Captain. This change was gradual, not abrupt. It was accompanied by a marked and most interesting progressive change in the manner of flight and general appearance of the Gulls. As the gale increased they flapped their wings less and less often, until most, if not all of them, were gliding ceaselessly, minute after minute, over distances certainly exceeding a mile, without a single wing beat but not without changes or readjustments in the bend or the inclination of the wings which took place not infrequently and often were very obvious. It was a rarely impressive and beautiful, as well as mysterious, sight — that of this orderly throng of silent, stately, almost snow-white birds, moving majestically on a perfectly level plane, at a speed of fifteen knots an hour, against a raging wind, yet making no visible muscular effort which could in any way account for such progress. Even more surprising was it to see, every now and then, one of them leave the rest and, going two feet to their one, forge on ahead of them all perhaps to the bows of the steamer and beyond, yet without once beating its wings. They seemed, indeed, to now have abundant speed *held in reserve* and to be able to retard or accelerate it at will, without obvious means of so governing it. Dr. Allen, who watched them with me for a time but not, unfortunately, when the gale reached its height and they were doing their best, fully shared my conviction that they could not possibly be making use of previously acquired momentum but that the wind itself must furnish their chief if not only means of propulsion. After he had

gone below it shifted to almost dead ahead and blew for half an hour or more with extreme violence. The Gulls were now heading, I should say, within a point and a half of it yet continuing to sail into it with undiminished ease and speed. The gradual increase in its strength and in the duration of their gliding flights, was accompanied by a very noticeable progressive change in the way their wings were held. This is difficult to describe but essentially it may be said to have consisted (1) in the more backward set of the whole wing; (2) in the greater crooking or bending of the wing at the carpal joint; (3) in the much more decided downward trend of the flight quills, especially the secondaries, which were so bent down and forward towards their tips as to give the wing when viewed from in front a conspicuously incurved or hollowed aspect similar to that shown by Hawks, Pigeons, etc., caught by the camera in the act of "back-pedaling" just before alighting. At the height of the gale the Gulls' wings were held so very far to the rear of their usual position that very much of the body was shown in advance of where they seemed to join it. The neck, too, appeared to be exceptionally elongated and its contour plumage, with that of the head and body, unusually compressed. In other and briefer words the birds seemed to have advanced as far as might be their centres of gravity, to have reduced as much as possible the resistance offered by their heads, necks and bodies to the wind, and to be employing its force to drive them for miles, almost straight into it, by merely letting it beat against their rigid and peculiarly placed and adjusted wings. As I stood watching half a dozen or more of them only a few yards away, sailing serenely and impassively through gusts which forced me to cling with both hands to a railing to avoid being blown bodily across the deck, it occurred to me that their swift and effortless progress might be due, at least in part, to the impact of the wind on the terminal portions of their depressed and stiffly-held primaries and secondaries. That these were incessantly agitated and sprung upward by the wind was plainly to be seen. They must be similarly bent, of course, whenever there are strong, downward strokes of the wings. Photographs of large, slow-flapping birds engaged in ordinary flight, fail to indicate that such wing strokes are often directed sufficiently backward to be altogether or even largely in the nature of rowing movements. On

experimenting with severed wings stiffened by drying I have found that when held firmly in the hand by their outer (*i. e.* bony) edges and struck smartly downward they give one very decidedly the impression that there is a resultant and by no means inconsiderable *level* thrust which in the living bird would be directed forward and might help materially to speed it on its way. If impetus may be so derived it must be due to the leverage of the long, elastic flight quills. Firmly attached at their bases to the rigid, bony structure along the edge of the wing but free towards their tips to be uplifted by impact on the air, these feathers perhaps act somewhat as a crowbar is made to serve by the mason when, after inserting one of its ends under a heavy stone, he lifts at the other end and thereby forces the stone forward over the ground without raising it. Whether or not the suggestions just hazarded have any value — a friend has characterized them as no less absurd than the old time assumption that a man may lift himself by his boot straps — there is, I think, little or no doubt that the wind constantly fills the concave wings of the gliding Gulls much as it does the sails of close-hauled vessels and with similar results but with this essential difference; that whereas its force is exerted for the most part laterally on the vessels' sails and opposed by the side thrust of their keels or centreboards in the water, it must have chiefly a lifting effect on the wings of the Gulls and be counteracted by the weight of their bodies bearing downward. Hence we may infer that in the case of these birds forward movement is the resultant of two component forces, that of wind and of the attraction of gravitation.

The theory last stated is not novel of course. It has recently been taken up and in certain ways effectively demonstrated and supported by G. F. Tydeman[1] who, writing in French and making extensive use of abstruse mathematical calculations accompanied by diagrams to illustrate them, deals particularly and most interestingly with the flight of sea birds. His observation of it has apparently been so much more extensive than mine that I hesitate to differ with him respecting any of his assumed facts or resultant

[1] Le Vol. Plané Des Oiseaux par G. F. Tydeman. Archives Néerlandaises des Sciences Exactes et Naturelles Publiées par La Société Hollandaise Des Sciences à Harlem. Series III B (Sciences naturelles), Tome I, 1e et 2e Livraisons. La Haye, 1911.

conclusions.[1] I cannot accept all of these, however, and I am especially unwilling to endorse his belief that birds gliding to windward depend for means of propulsion largely if not wholly on uplift afforded by powerful ascending currents of air such as must always rise above a vessel when heavy wind is striking against and deflected from, her sides. The possibility of this was thought of and at first more or less favorably considered by Dr. Allen and me as we watched the Gulls from the deck of the 'Arabic,' a month or more before Mr. Tydeman's article came to our notice. But I dismissed it altogether from my mind after repeatedly seeing birds hundreds of yards behind the steamer, or fifty or more yards to one side (always the windward one) of her, or even well in advance of her, gliding on set wings in precisely the same manner and quite as ceaselessly as those which hung about her flanks. It seems inconceivable that her presence or movement could have caused vertically rising currents of air to be regularly maintained at such distances from her as those just mentioned, or that they could have been thus constantly and generally maintained by other influences when the ocean all about her was swept by a wind blowing over thirty miles an hour. I even doubt if they extended much above her upper deck for there I was lashed incessantly in the face by what seemed to be horizontally-racing wind, while several of the Gulls were often sailing fifteen or twenty feet higher still, perhaps directly over me. On the other hand it must be admitted that I have never known any of these birds to glide far to windward except when accompanying a steamship, a fact which apparently lends some support to Mr. Tydeman's contention, although not necessarily having such significance since it may reasonably be interpreted in other ways.

Conducted of necessity through opposing and invisible air currents constantly varying in force and also somewhat in direction the gliding flight of the Gulls seems very wonderful, however it be explained. It would be impossible of execution were not the birds endowed with some intuitive sense which enables them to instantly

[1] So many of these are in close accord with mine that it may be well for me to state that the present article is based almost wholly on observations and impressions recorded in my journal or other notebooks before I knew anything about Mr. Tydeman. It is true that some of my views have been modified since his article was brought to my notice but this has been due not so much to its influence as to helpful criticisms and suggestions contributed by ornithological friends.

and accurately adjust and readjust the set of their wings and the equilibrium of their heavy bodies so as to meet in precisely the most effective way, without either loss or gain of headway, each successive gust and interval of comparative calm. With regard to individual proficiency and endurance in performing and maintaining such flight little if any differences were noticeable among the one hundred or more Herring Gulls who followed the 'Arabic' on the afternoon of August 2, 1911. Nor were two Lesser Black-backed Gulls (*Larus fuscus*) who accompanied them inferior to them in these respects. But two superb Great Black-backed Gulls (*Larus marinus*) who joined the throng at the height of the gale and kept along with us for half an hour or more just above the level of the upper deck flew, all the while, as most Gulls do on ordinary occasions, that is by alternate flapping and sailing, beating their wings vigorously every few seconds. Quite evidently the art of gliding far into the wind on set wings was beyond either their knowledge or their power, else surely they would have resorted to it, with scores of birds close about them practising it. Whenever, as not infrequently happened, the Herring Gulls descended to within ten or fifteen feet of the crests of the waves they, too, seemed unable to advance against the wind without frequent, vigorous wing strokes. At such low levels the gliding flight appeared, indeed, to be never even attempted by any one of them, a fact doubtless possessing no little significance if only one knew just how to interpret it.

Before sunset our escort of Gulls became much reduced and before dark all the birds had left us. Thus they did not follow us quite out of sight of the shores of Ireland where, no doubt, many of them had nests with eggs or young. No others of their kind rejoined us the following morning nor were any again seen until we neared the coast of Massachusetts.

My readers will understand, of course that what I have had to say in the way of attempted explanation of the movement of gliding Gulls represents little more than personal inference and opinion based on field observations made under favorable conditions but extending over only two half days. Hence it should be taken as suggestive rather than assertive. The problem to which it relates is too difficult to be dealt with thus superficially and at the same time effectively. Before attempting seriously to solve the

mystery one should study the metaphysics of the general subject of flight and familiarize himself with its voluminous literature. For so onerous a task I have had insufficient time and possibly not much real inclination. Being thus handicapped I should perhaps have abstained altogether from theorizing. But the temptation was irresistible and if, by yielding to it, I have originated nothing of value there will at least have been little if any harm done — save, perchance, to my scientific reputation.

TWENTY-NINTH STATED MEETING OF THE AMERICAN ORNITHOLOGISTS' UNION.

THE Twenty-ninth Stated Meeting of the American Ornithologists' Union convened in Philadelphia, Pa., Monday evening, November 13, 1911. The business meeting was held in the Council Room, and the public sessions, commencing Tuesday, November 14, and lasting three days, were held in the lecture hall of the Academy of Natural Sciences.

BUSINESS SESSION.— The meeting was called to order by the President, Mr. Edward W. Nelson. Eighteen Fellows were present. The Secretary's report gave the membership of the Union at the opening of the present Stated Meeting as 887, constituted as follows: Fellows, 48; Honorary Fellows, 11; Corresponding Fellows, 60; Members, 78; Associates, 690.

During the year the Union lost sixty-six members, eight by death, twenty-four by resignation, and thirty-four for nonpayment of dues. The deceased members include one Fellow, one Honorary Fellow, two Corresponding Fellows, two Members, and two Associates, as follows:

Henry Augustus Purdie,[1] a Fellow, and one of the Founders of the Union, who died in Boston, March 29, 1911, in his 71st year.

Dr. Adolf Bernhard Meyer,[2] an Honorary Fellow, who died in Berlin, Germany, February 5, 1911, at the age of 71 years;

[1] For an obituary notice, see Auk, XXVIII, p. 387; also Memorial Address in the present number.

[2] For an obituary notice, see Auk, XXVIII, p. 519.